LP CONSULTING
AUSTRALIA PTY LTD

- DESIGN AND PROJECT MANAGEMENT
- CIVIL ENGINEERING
- WATER AND WASTEWATER ENGINEERING
- BUILDING AND INFRASTRUCTURE
- HYDRAULIC AND FIRE SERVICES
- SYDNEY WATER ACCREDITED
- WATER SERVICING COORDINATOR, DESIGNER AND PROJECT MANAGER
- EXPERT TECHNICAL ADVICE

STORMWATER MANAGEMENT REPORT

Ref: 2017-1224- C

Friday, 3 November 2017

The Somerset Private Hospital Pty Ltd
Level 5
75-85 Crown Street
WOOLLOOMOOLOO NSW 2011

RE:- SOMERSET PRIVATE HOSPITAL
38 SOMERSET STREET & 29-33 DERBY STREET, KINGSWOOD
STORMWATER MANAGEMENT REPORT

1 INTRODUCTION AND OVERVIEW

This design report addresses the Stormwater Management measures associated with the proposed Development Application for a new private hospital facility. LP Consulting Australia *(LP Consulting)* has prepared the following drawings in support of the documentation prepared by Architect, Bureau SRH: -

Site Stormwater Drainage

- DA-STW-001 Title Sheet and Locality Plan
- DA-STW-002 Legend, Abbreviations and Drawing List
- DA-STW-003 General Notes
- DA-STW-004 Survey Plan
- DA-STW-005 Erosion and Sediment Control Plan
- DA-STW-006 Erosion and Sediment Control Details
- DA-STW-101 Site Stormwater Drainage Plan
- DA-STW-102 Site Stormwater Drainage Basement 3 Plan
- DA-STW-103 Site Stormwater Drainage Basement 2 Plan
- DA-STW-104 Site Stormwater Drainage Basement 1 Plan

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- DA-STW-105 Site Stormwater Drainage Lower Ground Floor Plan
- DA-STW-106 Site Stormwater Drainage Ground Floor Plan
- DA-STW-107 Site Stormwater Drainage First Floor Plan
- DA-STW-108 Site Stormwater Drainage Second Floor Plan
- DA-STW-109 Site Stormwater Drainage Third Floor Plan
- DA-STW-110 Site Stormwater Drainage Roof Plan
- DA-STW-201 Site Stormwater Drainage Detail Sheet

This report is to be read in conjunction with the above drawings.

This design report addresses the following key areas :-

1. Existing site characteristics
2. Overland flow assessment
3. Water Sensitive Urban Design (WSUD) requirements
4. Rainwater storage
5. On-Site Detention (OSD) storage
6. Stormwater quality treatment measures
7. Temporary erosion & sediment control measures

The stormwater management assessment contained in this report is derived from the following reference documents.

- College, Orth and Werrington Creeks Catchment Overland Flow Flood Study
  Final Report – Volume 1 of 2: Report Text & Appendices – dated June 2017 (135 pages)
  prepared by Catchment Simulation Solutions for Penrith City Council
- College, Orth and Werrington Creeks Catchment Overland Flow Flood Study
  Final Report – Volume 2 of 2: Figures – dated June 2017 (441 pages)
  prepared by Catchment Simulation Solutions for Penrith City Council
- Penrith Development Control Plan (DCP) 2014 - C3 Water Management
- Penrith Development Control Plan (DCP) 2014 – C4 Land Management
- Penrith City Council – Stormwater Drainage Specification for Building Developments

EXISTING SITE CHARACTERISTICS

The proposed development site is currently occupied by four existing single dwelling residential lots as indicated by the yellow outline in the aerial photograph below.

The properties are adjacent to Somerset Street on the west and Derby Street on the south.

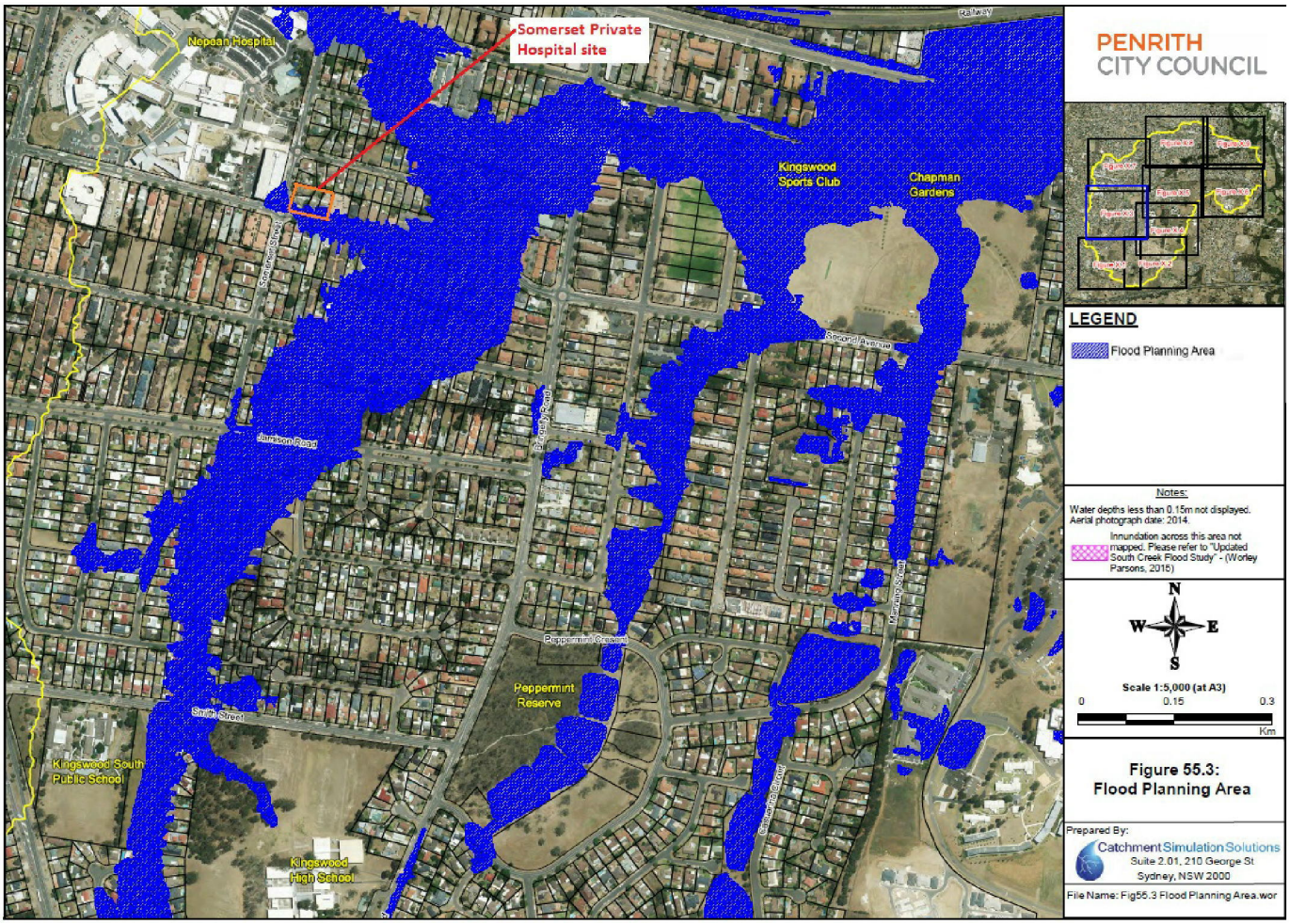
The site survey (extracted image below) indicates the existing surface generally falls away from Somerset Street in an easterly direction and towards the eastern boundary of 29 Derby Street. The lowest existing survey level within the property is located at the southeast corner with a value of RL47.64.

The total site area for the four existing lots is 2343m2 (less than 2500m2). The survey plan indicates an existing 675mm diameter council drainage pipe is located parallel to the Derby Street frontage and affords the opportunity for an underground stormwater connection with the provision of a new kerb entry pit.

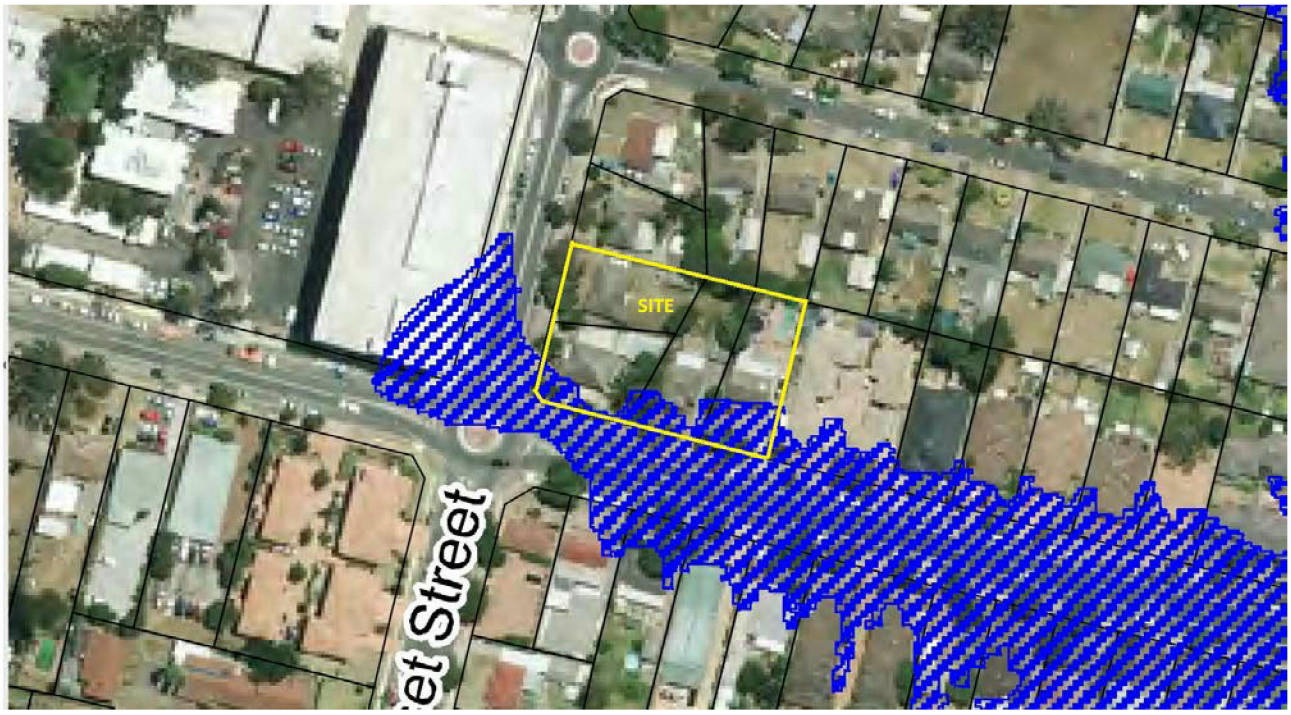
OVERLAND FLOW ASSESSMENT

A review of available Penrith City Council flood information for the site indicates the location of interest is affected by a designated flood planning area which extends in an east-west direction along Derby Street and appears to overtop the kerb alignment on each side of the road, extending in a north and south direction across the street frontage boundaries of several residential properties. Overland flow in the street appears to be the primary cause of local flooding effects, and not mainstream flooding.

The flood planning area (shaded blue below) indicates the areas where proposed floor levels should generally be designed with freeboard protection against the risk of floodwaters entering the building. Freeboard is a nominated vertical distance provided between the maximum water level of a particular flood event and the internal adjacent floor level of a building, or some type of flood barrier such as a protective driveway crest sloping down to a basement carpark.



The enlarged image below indicates the general flood planning extents, particularly along the Derby Street frontage, where the setting of proposed floor levels are of particular concern.



Existing street drainage (indicated with light blue lines in the image below) includes several pits and pipes collecting stormwater runoff from the roundabout intersection of Somerset Street and Derby Street, with underground flows being directed to the east along Derby Street.

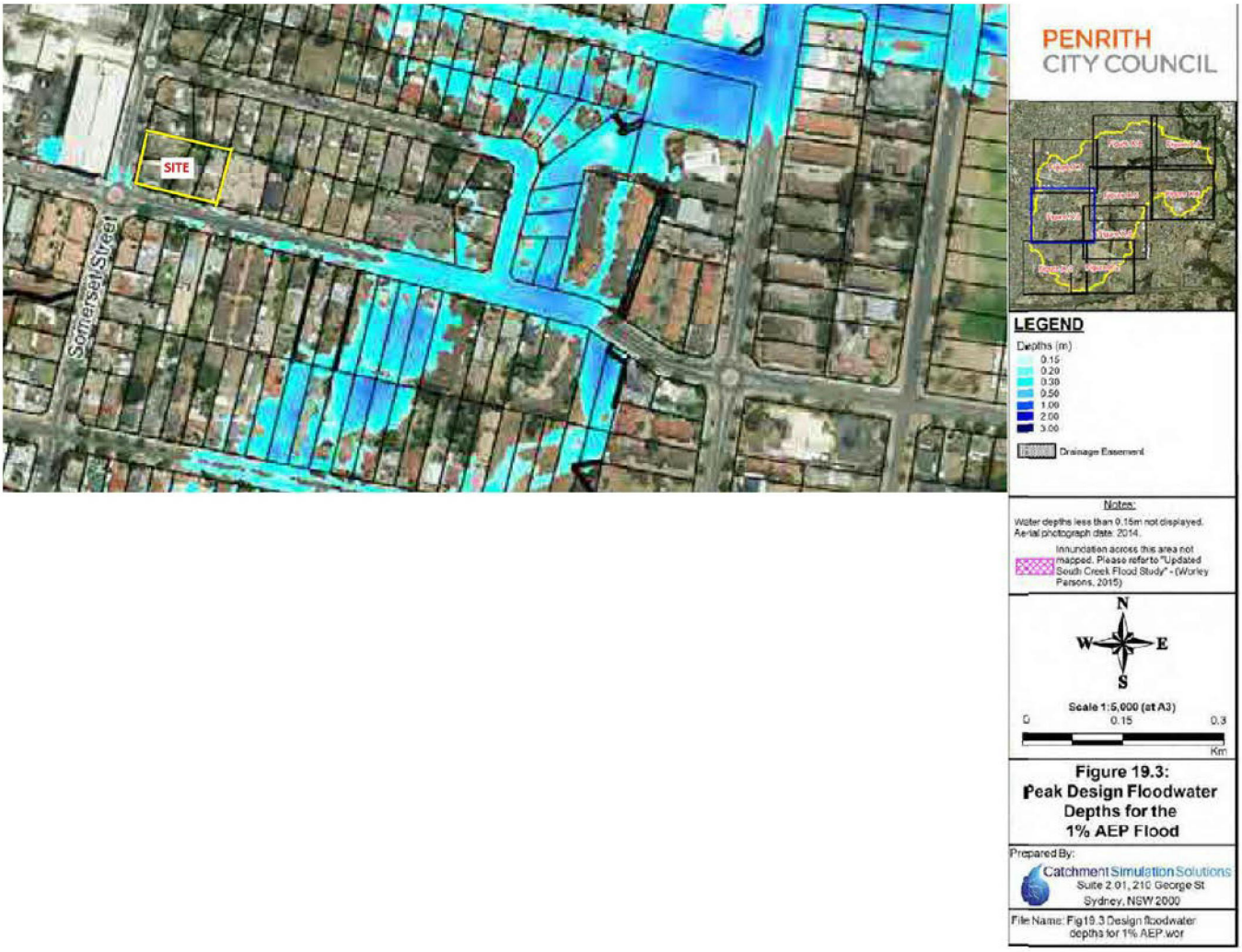
The enlarged image below indicates the pit locations as circles and the pipes as light blue lines.

9 Two particular storm events are of interest in this assessment:

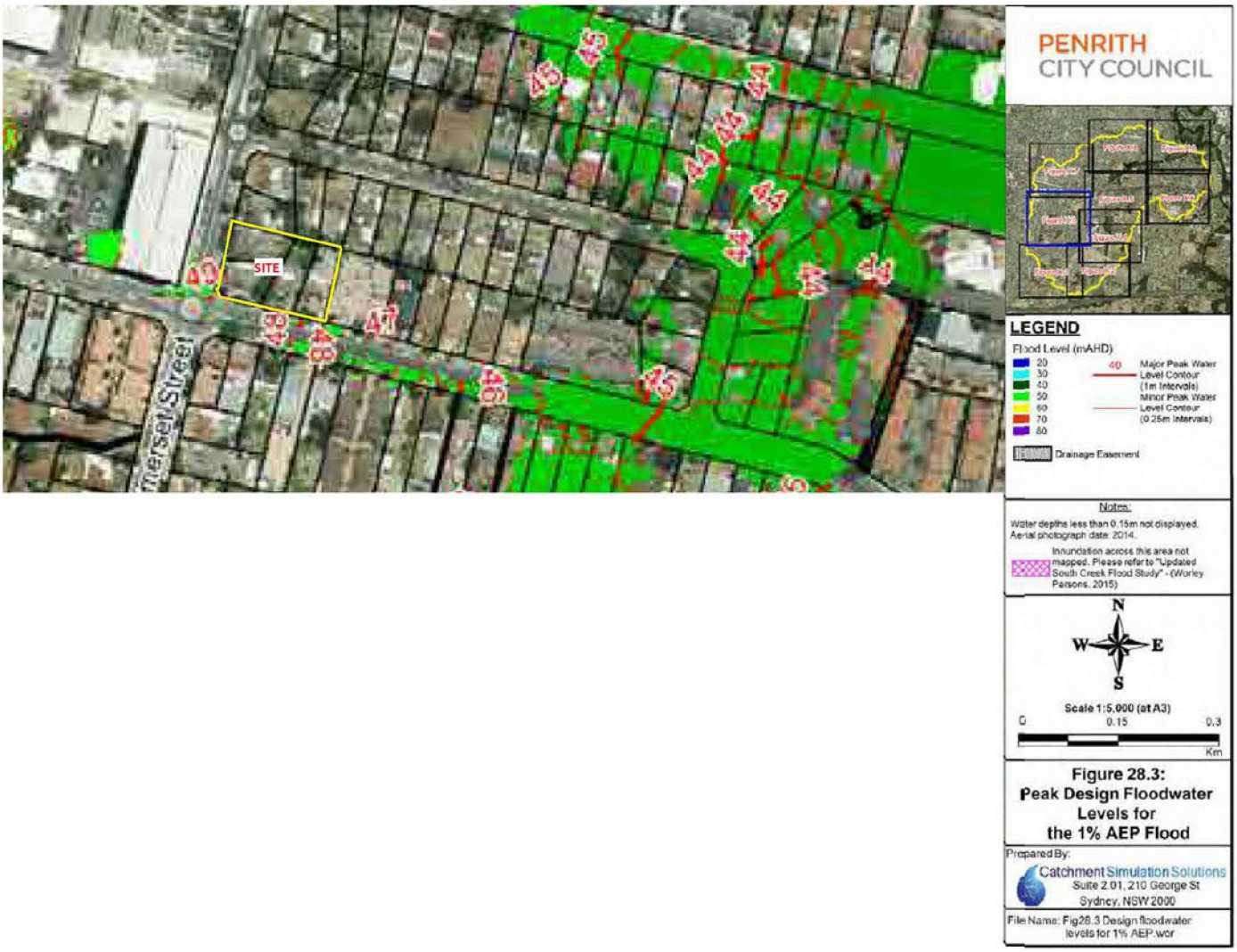
- The anticipated 100 year Average Recurrence Interval (ARI) flood; and
- the extremely unlikely Probable Maximum Flood (PMF) event.

Based on Penrith Council Development Control Plan 2014 – C3 Water Management – Section 3.5 Flood Planning - C. Controls – 6), for proposed new commercial or industrial developments, floor levels shall be at least 0.5m above the 1% AEP (Annual Exceedance Probability) or 100 year ARI flood. Lower internal floor levels are permitted as long as the building perimeter is flood-proofed up to the same level, as in the case of a driveway ramp crest protecting basement floors.

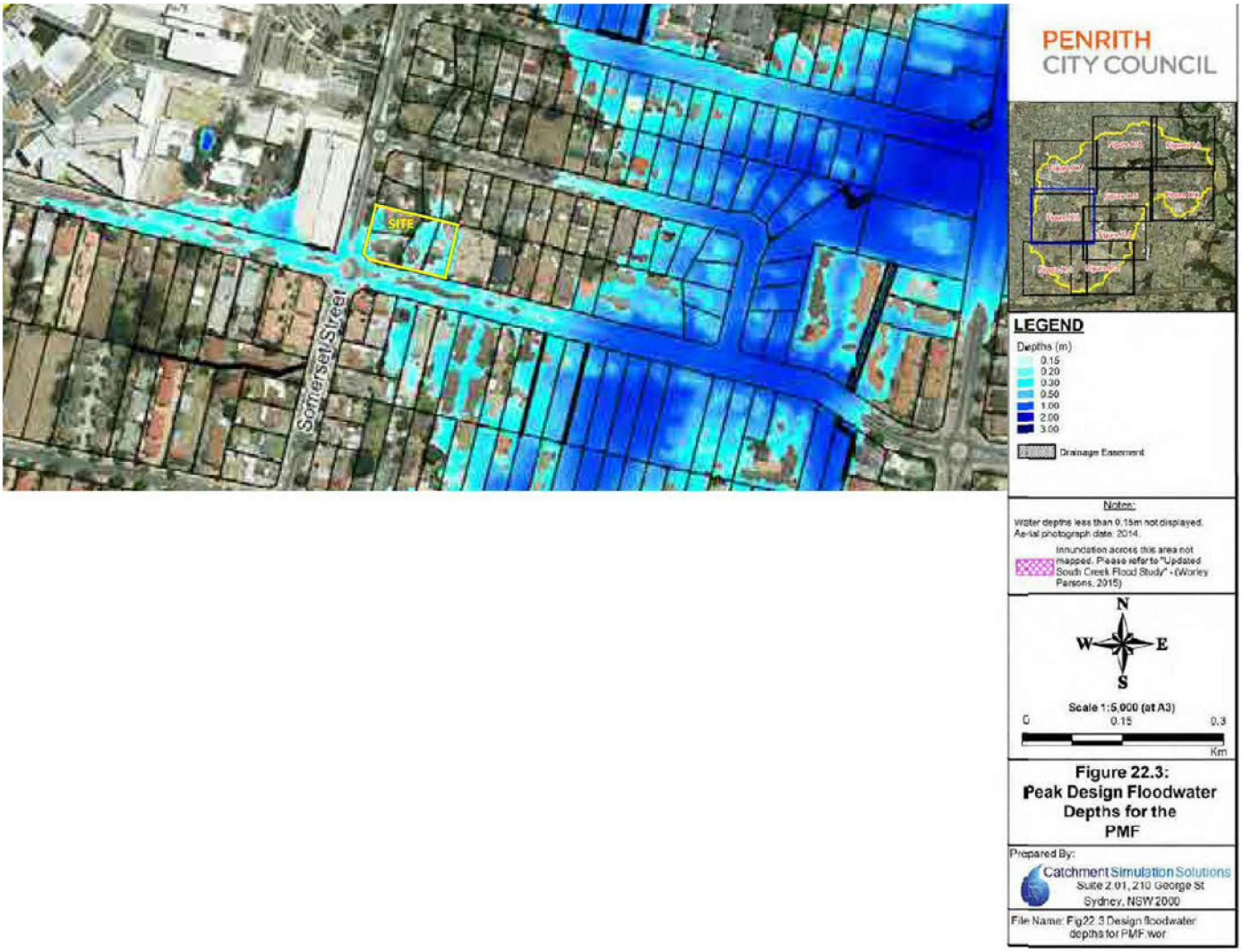
Indicative 100 year flood depths are shown below.



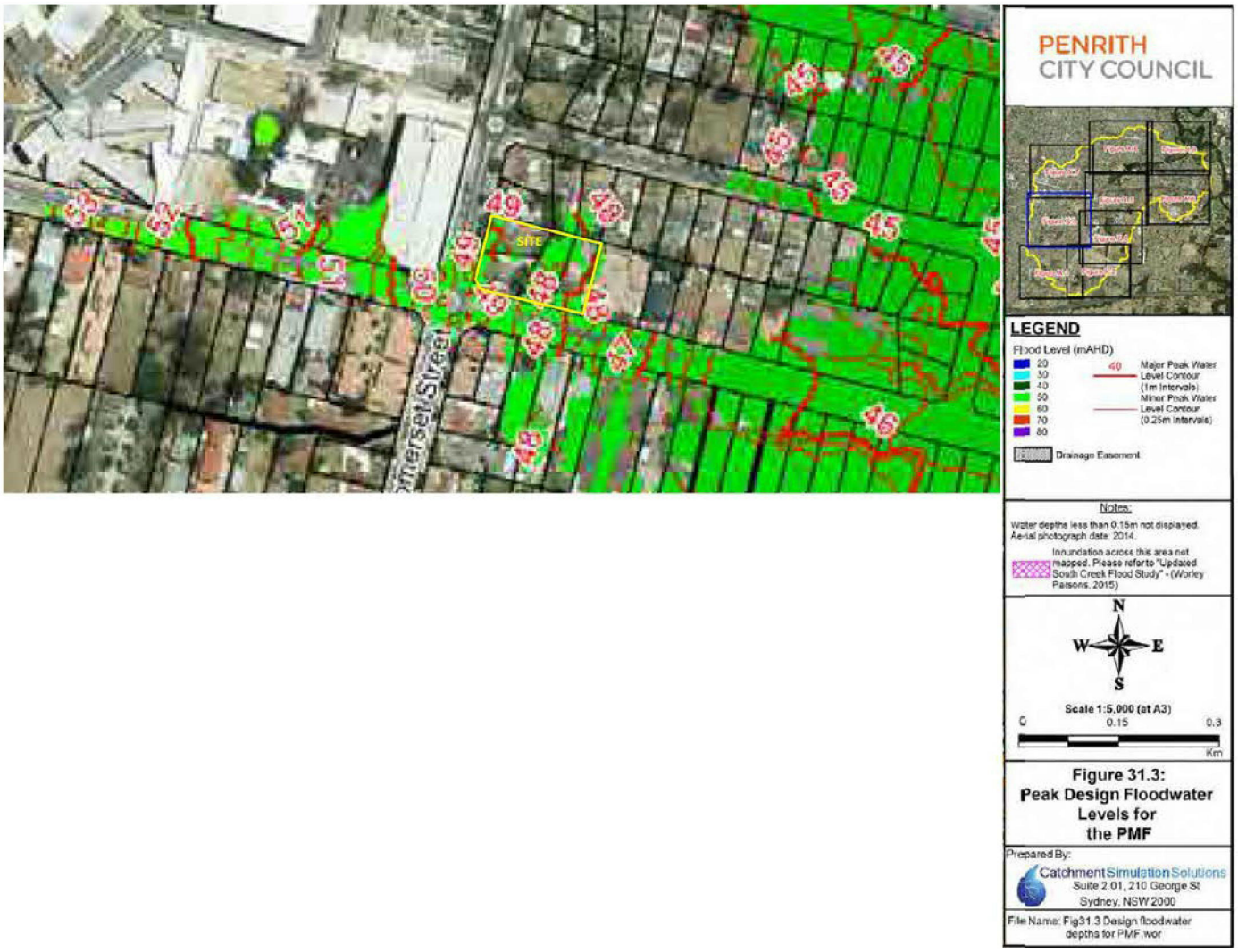
Indicative 100 year flood levels are shown below (approximate RL48.00 in the vicinity of the site, but not overflowing into the property).



Indicative PMF depths are shown below (for a very unlikely storm event).



Indicative PMF levels are shown below (approximate RL48.00 in the vicinity of the site and apparently overflowing into the property).

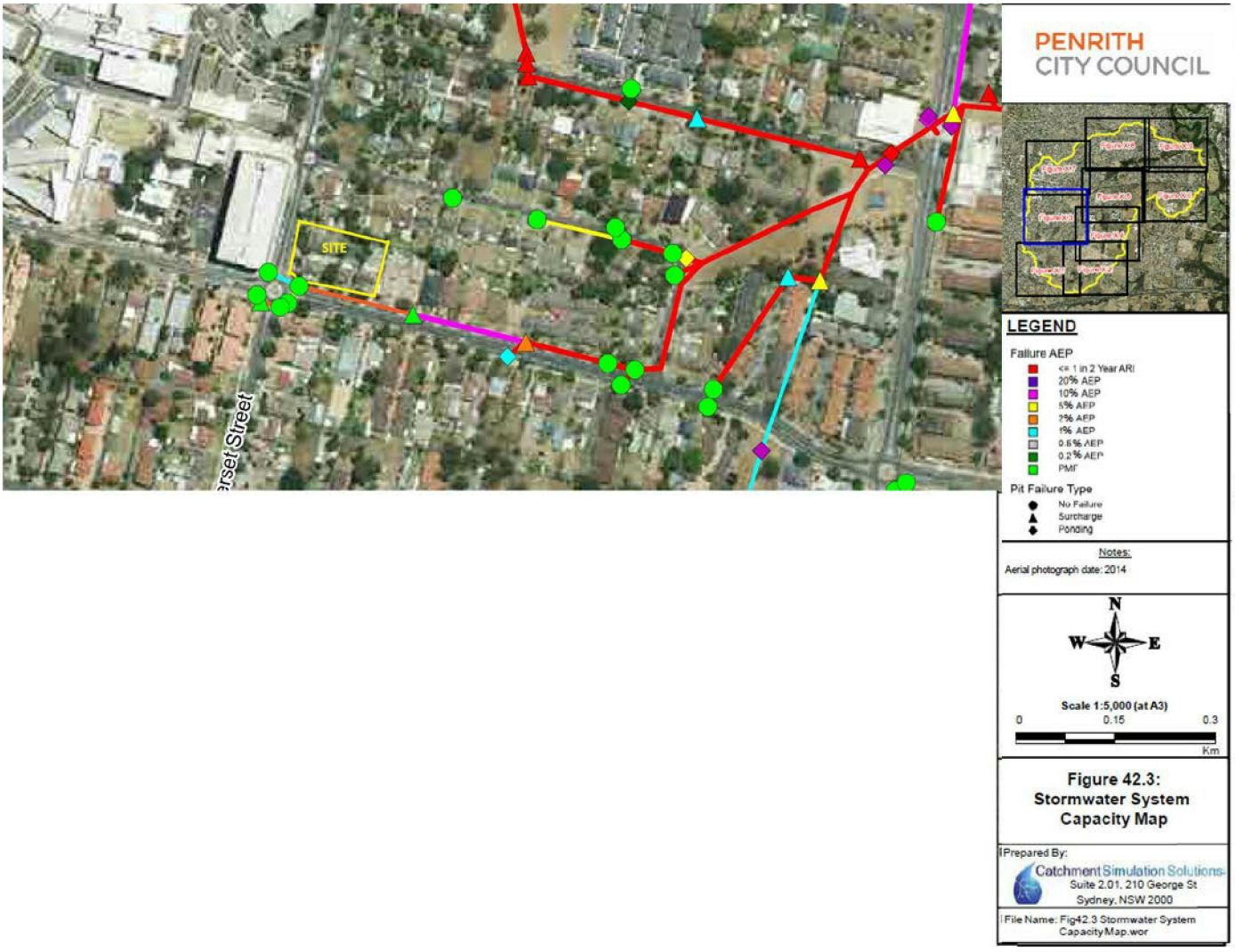


Estimated pipe system capacities are indicated below with colour-coded lines.

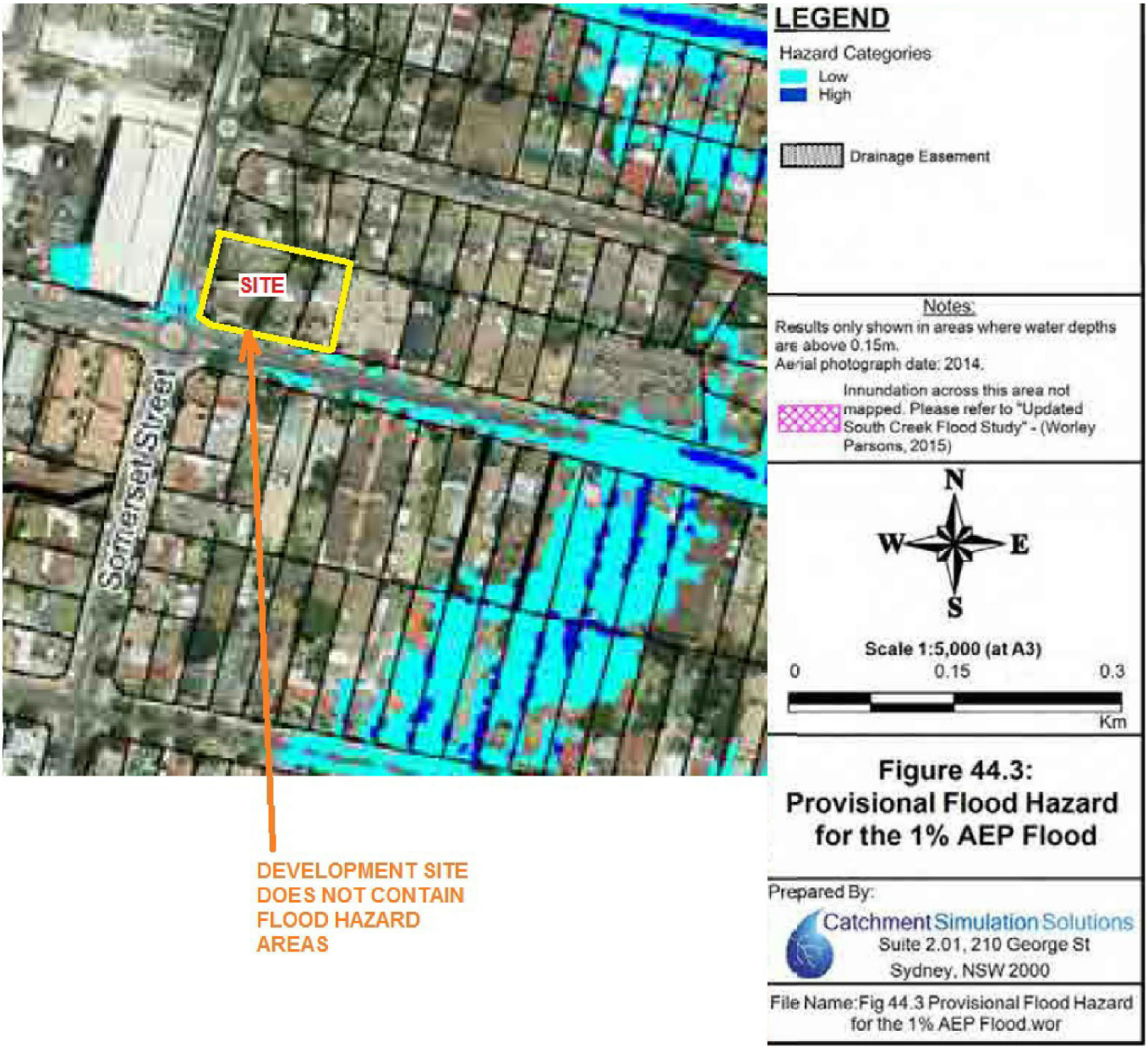
Orange-coloured street drainage can apparently contain 20 year (5% AEP) flows but would fail to contain 50 year (2% AEP) flows.

Light blue-coloured street drainage can apparently contain 50 year (2% AEP) flows but would fail to contain 100 year (1% AEP) flows.

Green-coloured circles indicate pit locations.



The flood hazard diagram below indicates that the development site does not include any flood hazard areas.



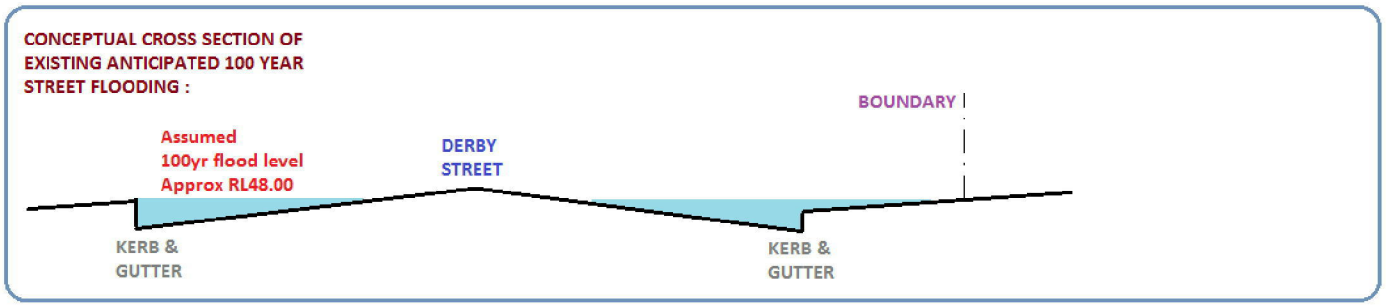
No high hazard floodwater depths and velocities are anticipated against the proposed building face, and 100 year ponding is considered to be confined to the public road reserve, rather than encroaching into the development site. Allowance for specific building construction measures to resist debris impact or extensive inundation are not considered to be necessary or applicable in this site context.

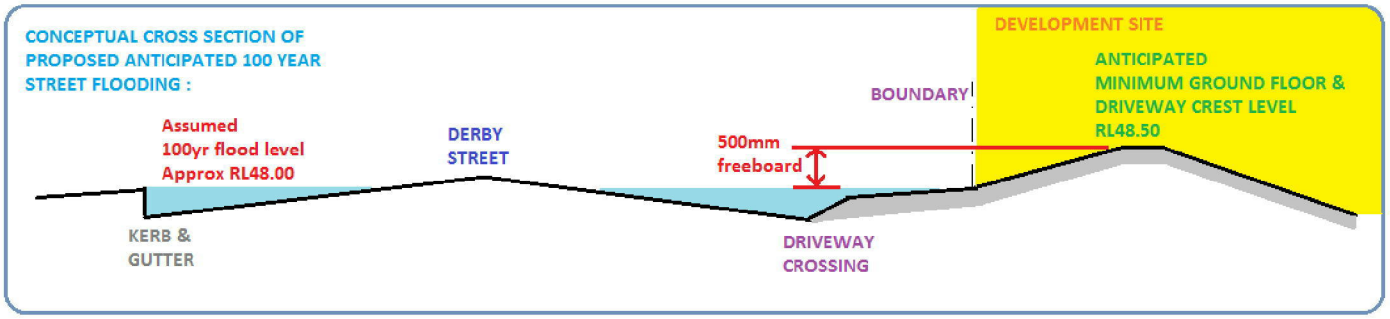
Near the lowest point of the existing development site, the available flood maps appear to indicate that 100 year ARI floodwaters would be present in the road reserve width, but would not significantly intrude into the properties on each side of the street.

16

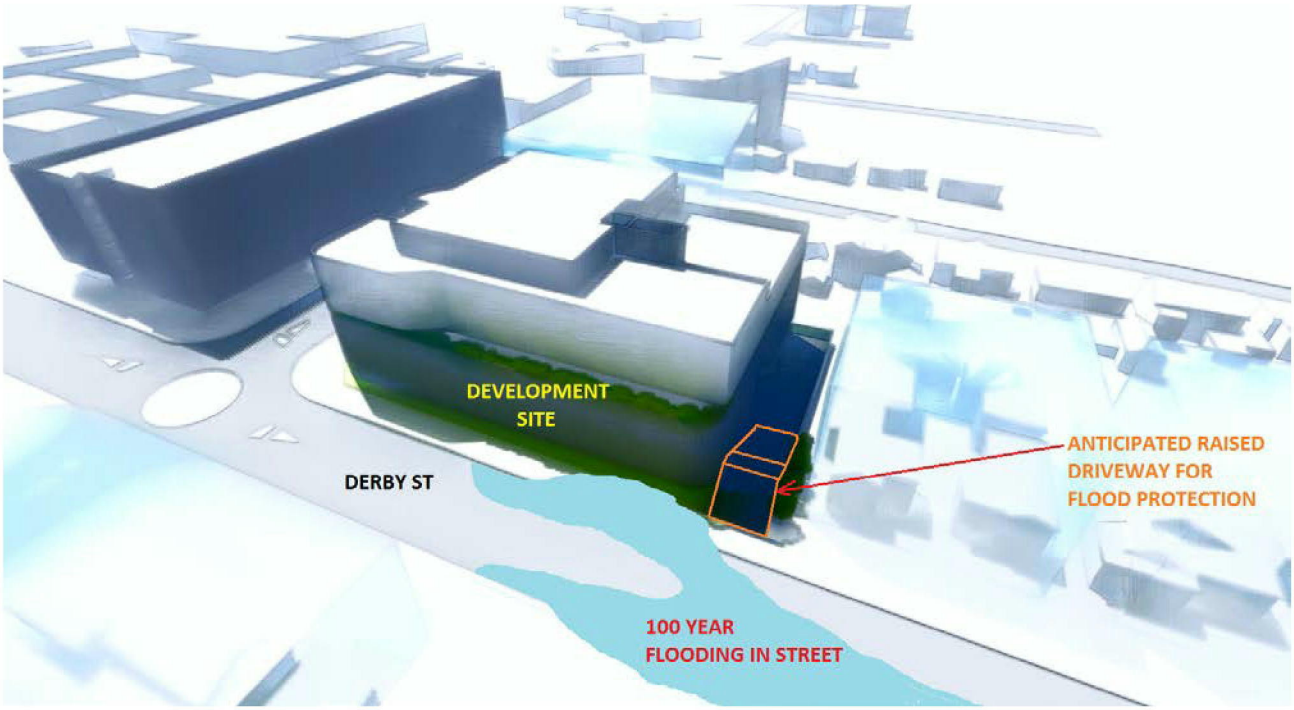
In contrast to this situation, the available flood maps also appear to indicate that (highly unlikely) PMF floodwaters would be present across the entire road reserve width, and would significantly intrude into the properties on each side of the street.

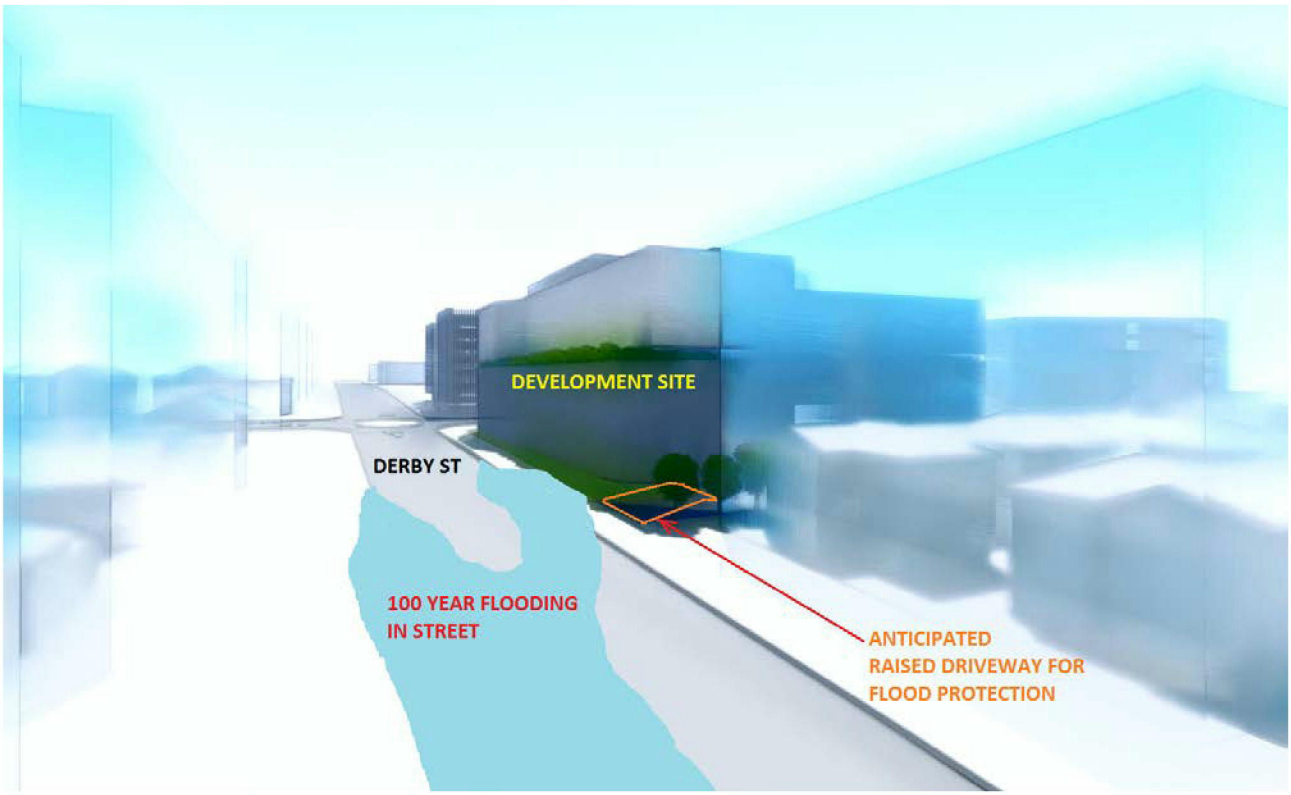
The conceptual cross-sectional views presented below indicate the existing anticipated 100 year flooding situation prior to development and the proposed flood protection situation with a freeboard distance applied to address the Council's Development Control Plan requirements. This is based on an approximate initial assumption of RL48.00 as the 100 year flood level deduced from the flood maps. Subsequent advice revises this initial estimate up to RL48.10.





The concept diagrams below indicate the proposed building and flood protection measure provided by a raised driveway ramp crest. It should be noted that the precise extent of 100 year street flooding is not well defined in the available low resolution flood study maps, but the flood level appeared to be approximately RL48.00. The street flooding extent is only indicative and not to scale on the diagrams below.





Since the extent of 100 year flooding or overland flow in the street appears to be contained within the adjacent road reserve and the site is located well away from the path of mainstream flooding, it is not considered necessary to undertake a site-specific flood study for the development of the proposed Somerset Private Hospital site.

In order to confirm the assumed approximate 100 year flood level of RL48.00, a flood level inquiry was submitted to Penrith Council on 21 August 2017 and the following response was received on 25 August 2017.

PENRITH

Our reference: ECM 7803260
Contact: Ratnam Thilliyar
Telephone: 4732 7988

25 August 2017

Isaac Yip
Suite 2, Level 8
15 Castlereagh Street
SYDNEY NSW 2000

Dear Mr Yip,

Flood Level Enquiry
Lot 16 DP31682 No. 29 Derby Street Kingswood

Please find enclosed Flood Level information for the above property.

Should you require any further information please do not hesitate to contact me on 4732 7988.

Yours sincerely

Ratnam Thilliyar
Engineering Stormwater Supervisor

PENRITH

Flood Information
Lot 16 DP 31682 No. 29 Derby Street Kingswood

Date of issue: 25 August 2017

The 1% AEP local overland flow flood level in the vicinity of the above property is estimated to be RL 48.1m AHD

Property less than 0.5m above the 1% AEP flood level is subject to Penrith Development Control Plan 2014 Section C3.5 Flood Planning. The Penrith Development Control Plan 2014 is available from Council's website www.penrithcity.nsw.gov.au.

Definitions

AEP – *Annual Exceedance Probability* – the chance of a flood of this size occurring in any one year.

AHD – *Australian Height Datum* – A standard level datum used throughout Australia, approximately equivalent to mean sea level.

Legend

	Extent of 1% AEP local catchment overland flow path. Generally depths less than 150mm is not shown.

Notes:

1. The contours shown above in yellow numbering are at 0.5m intervals and are based on Aerial Laser Scanning (ALS) Survey undertaken in 2002. The contour levels are approximate and for general information only. Accurate ground levels should be obtained by a Registered Surveyor.
2. The flood level is based on current information available to Council at the date of issue. The flood level may change in the future if new information becomes available. The 1% AEP flood is the flood adopted by Council for planning controls. Rarer and more extreme flood events will have a greater effect on the property.
3. Council's studies are reflected in flood mapping for the City which show properties potentially affected by overland flows in excess of 150mm.
4. This property is shown on Council's flood mapping as potentially so affected.
5. Council imposes flood related development controls where, in its opinion, such controls are justified. Such controls may or may not be imposed with respect to this property in the event of an application for development consent.
6. If a development proposal is submitted with respect to this property, Council will consider the possibility of flood or overland flow in the context of the application. Council may impose a requirement that the applicant for development consent carry out a detailed assessment of the possible overland water flows affecting the property (a flood study) and/or may impose other controls on any development designed to ameliorate flood risk.
7. You are strongly advised if you propose to carry out development upon the property, that you retain the assistance of an experienced flooding engineer and have carried out a detailed investigation.
8. Council accepts no liability for the accuracy of the flood levels (or any other data) contained in this certificate, having regard to the information disclosed in Notes "1" to "4". As such you should carry out and rely upon your own investigations.

Penrith City Council
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penrithcity.nsw.gov.au

Ratnam Thilliyar
Engineering Stormwater Supervisor

PENRITH
CITY COUNCIL

Note 2 of the Council correspondence indicates that the 1% AEP (or 100 year ARI) flood is the flood adopted by Council for planning controls.

Since the latest Council advice indicates a site-specific 100 year flood level of RL48.10 (rather than the initially assumed RL48.00) is anticipated for the development, and after applying the 0.5m freeboard height requirement, the minimum flood protection level should be no lower than RL48.60 for ground floor levels adjacent to the street and also for any driveway crest associated with a ramp down to the basement.

The architectural documentation prepared for the development application indicates the following proposed floor and driveway crest levels:

RL49.25 at Ground floor level
RL48.60 at driveway crest level

Both of these proposed levels meet the minimum requirement for flood protection on the basis on Council's flood advice.

WATER SENSITIVE URBAN DESIGN (WSUD) REQUIREMENTS

Reference is made to Penrith City Council's Development Control Plan 2014 - C3 Water Management in relation to commercial developments (including hospitals). Refer to Table C3.1 extract below.

4) Council Approval Requirements for WSUD Systems

Development types required to meet water conservation and stormwater quality and quantity targets are defined in Table C3.1. The performance criteria required to be met are listed below under subsection '5) WSUD Development Controls'. Affected developments must submit a WSUD Strategy (report dealing with measures to be implemented as part of the development) with a Development Application.

Table C3.1: Developments Required to Consider Water Sensitive Urban Design

Land Use	Development Type	Water Conservation 5(a)	Stormwater Quality 5(b)	Water Quantity Flow 5(c)
Commercial and Industrial **including hospitals**	All new commercial, retail, mixed use and industrial development greater than 2,500m^2 total site area **site = 2343m2**	√ - WELS	√	√
		This row is not applicable for a site less than 2500m2		
	Alterations and additions where the increase in roof area and impervious area* is equal to or greater than 250m^2.	√ - WELS	√	√
	Commercial, retail, mixed use and industrial development not addressed above **site = 2343m2**	√ - WELS	No	No
		This row is applicable and does NOT require compliance with Clauses 5(b) and 5(c)		
Other development not listed above	Any development which results in an increase of the existing impervious area by greater than 250m^2. Development includes but not limited to additional roads, driveways, vehicle parking areas, manoeuvring areas, loading and storage areas	√ - WELS (as required)	√	√

Note: √ means performance criteria detailed in subsection '5) WSUD Development Controls' apply.

Since the development site area occupies 2343m2 (and is less than 2500m2) water conservation measures such as water efficient fittings are considered to be applicable, but rainwater storage, stormwater quality measures and restrictions on water quantity flow are not considered to be mandatory for this development proposal. Email confirmation was also obtained from Penrith Council officer Tim Gowing on 9 October 2017.

RAINWATER STORAGE

Reference is made to the above WSUD tabular assessment and discussion. Rainwater storage is not considered mandatory for the development of the subject site and is therefore not proposed as part of the hospital development.

ON SITE DETENTION (OSD) STORAGE

Reference is made to Penrith City Council – Stormwater Drainage Specification for Building Developments in relation to exemption from on-site detention requirements. Refer to Clause 4.1 and Kingswood OSD map extract below.

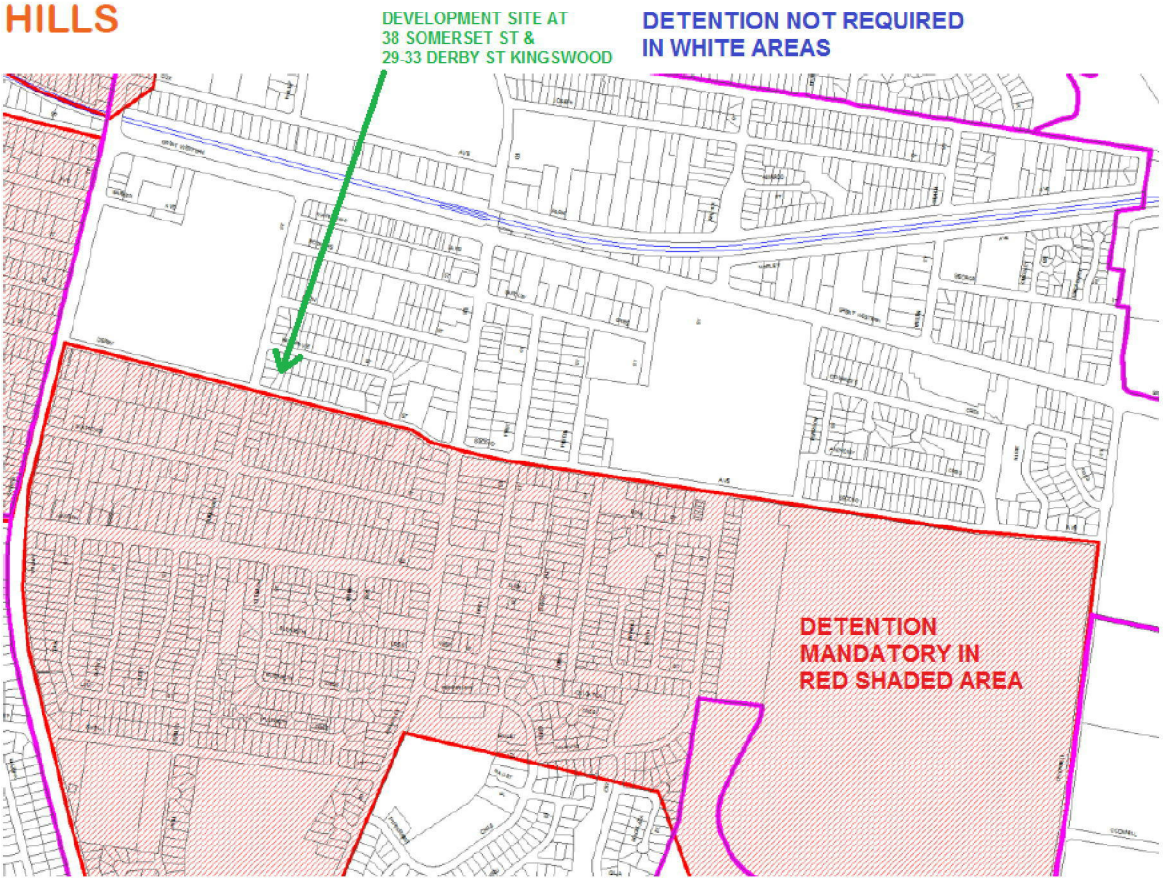
4. ON-SITE DETENTION (OSD)

4.1 DEVELOPMENTS REQUIRING OSD

Council has identified the following specific local catchments in Penrith Local Government Area where on-site stormwater detention (OSD) is mandatory (Appendix D):

- Penrith CBD
- Penrith North
- Lemongrove
- Emu Plains
- Jamisontown
- St Marys
- Colyton
- Oxley Park
- Dunheved & Werrington
- Kingswood & Orchard Hills
- Cambridge Park
- Erskine Park

ON-SITE DETENTION AREA - KINGSWOOD & ORCHARD HILLS



STORMWATER QUALITY TREATMENT MEASURES

Reference is made to Penrith City Council's Development Control Plan 2014 - C3 Water Management in relation to stormwater quality not be applicable to sites occupying less than 2500m2. Refer to Clause 5B extract below.

B. Stormwater Quality

Urban development increases the pollution load entering receiving environments. Stormwater quality controls have been derived through the modelling of numerous combinations of WSUD elements for a range of urban development types. They reflect a cost-effective level of stormwater treatment considered to be technically feasible in terms of land-take (or footprint) of stormwater and WSUD measures. Stormwater quality elements are to be sized using MUSIC modelling (the model for Urban Stormwater Improvement Conceptualisation, or equivalent) using Penrith data, which is available in the associated WSUD Technical Guidelines.

Objectives

a) To safeguard the environment by improving the quality of stormwater run-off entering receiving waters.

Performance Criteria

Stormwater quality requirements for all development types identified in Table C3.1 are:

a) Pollution load reductions: **Not applicable for sites less than 2500m2**

i) 90% reduction in the post development mean annual load total gross pollutant (greater than 5mm);

ii) 85% reduction in the post development mean annual load of Total Suspended Solids (TSS);

iii) 60% reduction in the post development mean annual load of Total Phosphorus (TP);

iv) 45% reduction in the post development mean annual load of Total Nitrogen (TN);

v) 90% Free Oils and Grease with no visible discharge.

TEMPORARY EROSION & SEDIMENT CONTROL MEASURES

During construction works the management of soil and water movement requiring erosion and sediment control is to be undertaken in accordance with the Landcom publication *Soils and Construction: Managing Urban Stormwater 4th Edition, March 2004* (also known as "the Blue Book"), as referenced in Penrith Council's Development Control Plan 2014 – C4 Land Management Clause 4.3 C.2)b).

The following **Erosion and Sediment Control Assessment** references the Blue Book guidelines.

Assumed area of soil disturbance = 2343m2
Take Rainfall Erosivity Factor R = 2400 for Kingswood (from Appendix B: Map 10 on Page B-12)
Take Site Slope = 2%
Indicative Erosion Hazard is Low (based on Section 4.4.1 Figure 4.6 on Page 4-10)
Used Revised Universal Soil Loss Equation (RUSLE) to check:
Take Soil Erodibility Factor K = 0.036 (from Appendix C: Table 19 for Warragamba on Page C-103)
Take Slope Length/Gradient Factor LS = 0.41 (from Appendix A: Using 80m Length in Table A1 on Page A-9)
Take Erosion Control Practice Factor P = 1.3 (from Appendix A: Figure A5 on Page A-12)
Take Ground Cover & Management Factor C = 1.0 (from Appendix A: Figure A5 on Page A-12)
Soil Loss = 2400 x 0.036 x 0.41 x 1.3 x 1.0 = 46t/ha/yr
Soil Loss Class = 1 (between 0 & 150t/ha/yr) (based on Section 4.4.2 Table 4.2 on Page 4-13)
Erosion hazard is therefore Very Low & there are no seasonal restrictions on site activity
For a soil density of 1.0t/m3 Average Annual Soil Loss = 46m3/yr
Since this is less than 150m3/yr, a sediment basin is not considered necessary (refer to Section 6.3.2(d) on Page 6-8)
For the area to be disturbed on this site, sediment fences or straw bales are considered satisfactory (refer to Section 2.1 on Page 2-1, Section 4.4.1(a) on Page 4-9 & Section 4.3.2(h)(iv) on Page 4-4)
Lengths of sediment fencing or straw bales should be arranged to limit subcatchment flows to 50L/s (refer to Section 6.3.7(e) on Page 6-34 & Section 2.3.1(e) on Page 2-4)
For 10yr 5min Intensity = 143mm/h & 10yr 1hr Intensity = 43.7mm/h a fully pervious area of up to 3600m2 can be accommodated by one length of sediment fencing or straw bales (refer to Figure 6-10 on Page 6-34)

Temporary construction measures to be undertaken include:-

- Sediment fencing on the low side of earthmoving operations;
- A gravel layer at the construction vehicle access point into the area of works
- Regular monitoring of soil movement characteristics and cleaning of sediment deposits as required during construction
- Security fencing around the area of construction works

CONCLUSION

This Stormwater Management Report for the proposed Somerset Private Hospital development identifies and addresses the following items relating to the development application assessment by Penrith City Council :-

- Existing Council street drainage along Derby Street is available for an underground stormwater connection;
- Mainstream flooding effects are not considered to be applicable to the site of proposed works;
- Local flooding due to overland street flows are anticipated, and adequate freeboard protection is to be provided up to ground floor and driveway crest levels;
- Council's Water Sensitive Urban Design Requirements have been reviewed and addressed;
- Council advice indicates that rainwater storage is not considered necessary for this development;
- On-site detention is not considered necessary due to the geographical site location;
- Stormwater treatment is not considered necessary due to the site area of the development; and
- Erosion and sediment movement is to be controlled during construction with suitable measures to prevent undesirable soil deposits around the works area.